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AUTHOR Doak, E. Dale, Ed.; And Others
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ABSTRACT

This monograph consists of papers delivered at the "Symposium on Simulation in Teacher Education" that was held to examine or define the state of the art of simulation in teacher education. The following papers are presented: (1) "Instructional Alternatives Available for Use in Professional Education" (D. R. Cruickshank); (2) "The Role of Interactive Video in the Acquisition of Teaching Skills" (Laurence D. Brown, David H. Gliessman); (3) "Creating a 'Recycling Center' for Teacher Thinking" (Greta Morine-Dershimer); (4) "Teacher Information Processing in the Management of Classrooms" (Willis D. Copeland); and (5) "Clinical Knowledge and the Unique Role of Simulation as an Instructional Strategy for Teacher Education: A Participant's Perspectives" (Marcia J. Keith). A summary of the symposium by E. Dale Doak concludes the document. (JD)

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Prologue

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Proceedings from
A National Invitational Symposium
November 13-14, 1986

**Clinical Knowledge and Simulation in
Teacher Education:
Prologue to the Future**

University of Tennessee
College of Education - Project AIM>TE
Claxton Addition
Knoxville, TN 37996
(615) 974-2653

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FOREWARD

Among the more useful concepts to emerge from learning theorist of this century is the notion of advanced organizers. These aids give those who would know some prior ways of helping learning to occur; they shape expectations, provide hooks for what is to come. Teachers are urged to provide advanced organizers with their students, though in school the term may be changed to "establishing set" or "creating the climate."

Forewords attempt much the same task: to prepare learners, folks who, in this immediate instance, are readers distant from the events being described in this Proceedings document. What occurred that occasions this effort was an invitational symposium held in the College of Education at the University of Tennessee-Knoxville on November 13 and 14, to which were invited many of the leading theorists in the country on the subject of simulation as a method of preparing teachers. Included among the invitees were those whose papers are here presented: Donald R. Cruickshank of Ohio State University, Laurence Brown and David Gliessman of Indiana University, Greta Morine-Dershimer of Syracuse University, and Willis Copeland of the University of California at Santa Barbara. Contributing significantly to the discussions these papers generated were such scholars as Susan Barnes of the Texas Education Agency, Walter Doyle of the University of Arizona, William Gardner of the University of Minnesota, Robert Schuck of Mississippi State, Katherine Badt of the University of Virginia, and Richard Wisniewski of the University of Tennessee. A number of professors from the College of Education at UTK also participated. The whole affair was planned, coordinated, and moderated by E. Dale Doak, a UTK professor who has put together a state of the art teaching simulation laboratory on the UTK campus, and by Marcia Keith, AIM>TE Project Coordinator. It is important to note that the funds to support the symposium came from the Matsushita Foundation, whose head, Dr. Sophie Sa, attended all the sessions and, though not a professional educator herself, added an insightful dimension as an intelligent lay person concerned about education in general and teacher preparation in particular.

Cruickshank's paper both opened the symposium and provided a challenge not only for the participants

but also for all who prepare teachers: "Teacher educators must be well-acquainted with instructional alternatives if they are to model them and instruct novice teachers in their use." His was a clarion call for more simulation, more on-campus training, both for what such efforts can achieve and for what their use permits teacher educators to discard or lessen. Among the latter is the continuing reliance on student teaching as the "norm for laboratory-clinical preparation." As Cruickshank noted, student teaching "approximates trial-and-error learning in that...it generally takes quite a few trials for novice teachers...to discover something for themselves." Student teaching may be "but often is neither laboratory nor clinical-like." Such experiences, Cruickshank argued, must be supplemented with on-campus laboratory learnings, the kinds that permit the pinpointing of skills to be learned, the optimal settings for such learning, and feedback about it.

Brown and Gliessman's paper focused on research they have done at Indiana University on the uses of interactive video. Saying that "the act of teaching is conceptual, that it is moored in concepts about what is being taught, to whom it is being taught, and for what purpose," they discussed their production of three different films to be shown to prospective teachers for their interpretation. These films require that viewers (prospective teachers) "interact"; i.e., teacher education candidates could, for example, observe and record; they could solve problems that are suggested but unresolved in the films; they could develop strategies or mull over concepts. Though their work is still in progress, the authors suggested that their future filming in actual classrooms will provide several hours of footage which can be modified and rearranged, using computer technology, to create a "very large number of interactive video instructional units for demonstration purposes."

In a teacher education class at Syracuse University, Morine-Dershimer was demonstrating the synectics model of teaching by asking her students to answer this question: "The teacher is like what machine?" One student provided the useful metaphor that Morine-Dershimer borrowed for the title of her paper: "The teacher is like a recycling center because we contribute to the survival of our natural resources (children) by taking old bottles (concepts), breaking them up, and making new ones." Morine-Dershimer

suggested that using simulation in teacher education is, in effect, a recycling. Her own work, she explained, is focused on a computer program on teacher decision making. The simulation "involves a data bank of information on 14 elementary school children entering the fifth grade." The available information consists of their school records from kindergarten through fourth grade, and includes family backgrounds, standardized test scores, records, IQ and creativity measures, report card grades, summaries of parent conferences, health and attendance records, sociometric data, individual interests, and samples of class work in writing and arithmetic." Given this extensive data bank, teacher education students can make such decisions as those involved in grouping pupils for reading instruction and those needed to allocate classroom time. These are the first two areas of decision making Morine-Dershimer uses with her students because these decisions can be informed by research. The author next presented data about the elementary education students who have experienced the simulation, the modifications she has made as a result, and her "attempts to learn how novice teachers become experts." She concluded that such learning "may be the most important contribution of the simulated experiences we are creating in our recycling center."

Copeland described a research study that explored teachers' multiple-attention and vigilance skills and correlated these with observation of teachers' management behavior. Using a simulation he entitled "Arithmetic Drill Game" and drawing on Kounin's seminal work on withitness (the ability teachers possess that permits them to know what children are doing in the classroom--the proverbial "eyes in the back of the head") and overlap (the ability teachers have to separate issues simultaneously), Copeland sought answers to two questions: (a) "What is the relationship between subjects' scores on the Arithmetic Drill Game and subjects' ability to demonstrate withitness and overlap skills while managing typical classroom learning situations in the field?" and (b) "does playing the Arithmetic Drill Game evoke in subjects' thought processes and emotions similar to those experienced by the subjects while managing classroom-based group learning situations?" Copeland's research suggests that the Arithmetic Drill game does simulate aspects of teaching and provides scores which are related to players' withitness/overlap abilities.

These compelling papers and the stimulating discussions they generated occupied participants for most of Day Number One, including time set aside for coffee breaks and lunch. Get together a group of experts who work more or less on the same fronts of knowledge and there will seldom be long periods of silence. Even dinner that first evening was sparked by a continuing exploration, an informal one. This was followed, however by a formal small group session in which participants were charged by Doak to plumb what clinical knowledge means, what attributes of teacher preparation are amenable to in-clinic presentation, and by what means. Like the posse in the beginning writer's western story, the groups rode off in all directions, yet found their work the richer for the variety and interchange.

That same variety paradoxically diffused and sharpened the focus of the next morning. Diffusion resulted when it was discovered that even members of the same group differed on what they had said the previous evening. Sharpening came about as the perceptions and opinions of different groups were found to be more in harmony than in dissonance. In these proceedings, Keith has undertaken the task of reporting the diffusion and the sharpening. Written after the symposium ended, her paper reflects what most participants would agree to--that clinical knowledge, however defined and implemented, is crucially important in teacher education; that clinical knowledge must be informed by the best available research base, including in-field ethnographic data; and that the clinical knowledge aspect of teacher education may be the most appropriate area for simulation as an instructional technique. Keith reproduces a developed-in-the-moment matrix that participants agreed was a powerful way to suggest how simulation may be used in teacher education...in ways already tried, in those yet to be discovered.

Doak's paper, which concluded the Symposium, provides both a summary and a challenge for the participants, and for the reader of these proceedings. All who were there felt keenly that simulation is an idea whose time had returned. The efforts of the late 60s and 70s provide a basis in history for current attempts. Those interested in simulation can replicate earlier work and modify it in light of new discoveries.

But there is also the demand for vision, for the dream so far undreamt, as new and fruitful ways of using simulation must be developed. The question for teacher educators is no longer Whether? It is How?

Ted Hipple
Head, Department of
Curriculum and Instruction
University of Tennessee-Knoxville

Instructional Alternatives Available for Use
in Professional Education
D.R. Cruickshank
The Ohio State University

Toward a system of classification.

Teacher educators must be well-acquainted with instructional alternatives if they are to model them and instruct novice teachers in their use. The purpose of this section is to present a tentative classification system that permits us to know many ways of teaching teachers and some of their common and uncommon features so as to allow us to make better teaching methodology selection decisions.

The proposed classification system for instructional alternatives derives from and is an elaboration of an existing model or representation of learning experiences made popular by Dale (1969) that, in turn, derives in part from the concept of three "modes of representation: suggested by Bruner (1966). According to Bruner:

Any domain of knowledge (or any problem within that domain) can be represented in three ways: by a set of actions appropriate for achieving a certain result (enactive representation); by a set of summary images or graphics that stand for a concept without defining it fully (iconic representation); and by a set of symbolic or logical propositions drawn from a symbolic system . . . (symbolic representation).

Dale likens Bruner's notion of enactive representation of knowledge to direct first-hand experience. Thus one may come to know by doing, e.g., learning about teaching by teaching. According to

1

This paper is an elaboration of Cruickshank (1985). "Instruction in teacher education: in Models for the preparation of America's teachers, pp. 82-83.

Dale, "An experience of doing calls for a good deal of concrete, direct, immediate action in which we make full use of our senses and often our muscles as well." (p. 108)

Iconic representations are likened by Dale to representative, pictorial experiences. Although the analogy is less precise here, one may come to know by seeing, e.g., learning about teaching by observing others teach.

Finally, knowledge may be represented abstractly or symbolically, e.g., learning about teaching by reading or listening to communications about teaching. Symbolic representations of knowledge cause us to know using only our thoughts and ideas without proximate recourse to experience or imagery.

Dale cautions that, if a learner has too little previous enactive or iconic experience to draw from, the symbolic will probably have no real meaning because it cannot be related to anything familiar. Moreover, Bruner notes that students make use of their previous enactive and iconic experience when dealing with new problems (pp. 136-137).

Hypothetically, it follows that learning experiences or, as I chose to say instructional alternatives that provide learning experiences, should be capable of being arranged along a continuum from enactive-direct to iconic-pictorial to symbolic-abstract. Dale did this for a limited number of instructional alternatives available to K-12 teachers and called the resultant visual analogy the "cone of experience" (pp. 106-135). (See Figure 1.) However, therein he mixed, and perhaps confused, instructional alternatives (e.g., demonstrations) with materials or equipment that provides them (e.g., television).

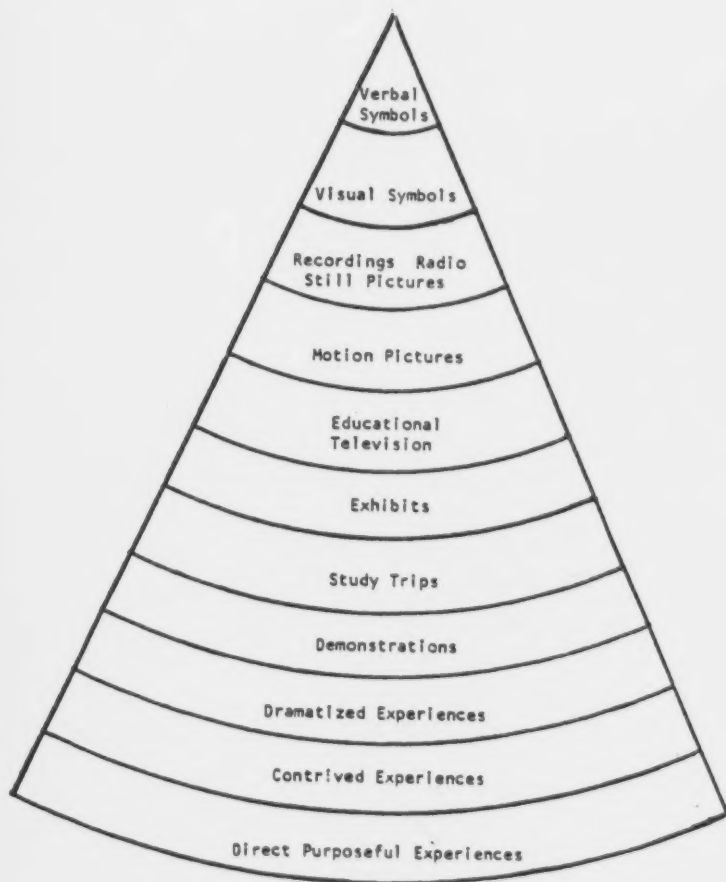
Borrowing and extrapolating from Dale who, as previously noted, was addressing instructional alternatives for use in K-12 teaching, it is possible to conceive of instructional alternatives available for use in teacher preparation as falling along a similar concrete to abstract continuum of experiences. Where students of teaching would achieve the desired ability through direct, first-hand or personal experience, the instructional alternative would be considered concrete. Where they would achieve the desired ability indirectly, through second-hand, visual experience, the instructional alternative would be considered vicarious since it is gained through

sympathetic or imagined participation in the experience of another teacher. Where students of teaching have neither a concrete nor vicarious learning experience, i.e., they do not have the experience themselves nor visually witness others having it but instead obtain it through third-hand accounts gained through reading or listening, the experience is considered abstract.

The above conceptualization permits available instructional alternatives that provide teacher education experiences to be placed under one of the three rubrics. For example, under concrete, direct, first-hand experience can be placed all forms of field and on-campus teaching wherein the student of teaching actually performs teaching functions. These forms include student teaching, Microteaching, Reflective Teaching and engagement in simulators and with selected simulation-games. Under vicarious indirect, second-hand experience can be placed observations of either naturally occurring or demonstration teaching, use of protocols or records of teaching events of educational significance, use of documentary films, still pictures and filmed or written factual, and fictitious accounts of teaching. (In the latter case the concept vicarious is stretched a bit.) Finally under abstract, third-hand experience can go a large assortment of instructional alternatives whereby students of teaching learn an ability (concept, skill or attitude) with little or no access to reality or a model of it. Such alternatives include academic contests or competitions, brainstorming, case studies, colloquia, debates, discussions (group, panel), lecturing, oral reports, programmed/computer-assisted instruction, project-group activities, recitations, surveys-interviews, symposia and team (collaborative) learning.

Although Dale did not do so, it is possible in this instance also to conceive of instructional alternatives for use in teacher preparation as falling along a second continuum or dimension, that of "context of experience: real or modeled." For example where the student of teaching would achieve the desired ability in situ, i.e., in the natural K-12 context, the instructional alternative would be labeled "real". On the other hand, where the student of teaching would achieve the desired ability not in situ but rather utilizing a contrived context or environment, the

Figure 1. The Cone of Experience



instructional alternative would be labeled "modeled." An example of the former is student teaching, the latter simulations.

Thus instructional alternatives available for use with students of teaching can be thought about and arranged along two continua: "types of experience"; concrete, vicarious, abstract and "context of experience"; real or modeled. Figure 2 provides a tentative conceptual map accordingly.

Under concrete-real the student of teaching obtains direct, first-hand experiences with teaching in K-12 contexts. Under vicarious-real they are obtained indirectly and second-hand via live observations or observations of recordings of teachers in K-12 classrooms (including autobiographical records of teaching). Under concrete-modeled the student of teaching gets direct, first-hand experience with teaching but in a contrived context as in Microteaching, Reflective Teaching and in simulators. Under vicarious-modeled, the learner gains indirect, second-hand experience from fictitious records of reality such as fictional films or books. Finally, under abstract, the experiences are third-hand that is neither enactive nor iconic. Herein students of teaching learn about teaching from abstractions whereby the inherent qualities and properties of teaching have been separated from their actual occurrence.

Of course, instructional alternatives available for use in teacher education have other properties that make them more or less desirable according to such variables as instructors' teaching biases, learning outcomes and class size. Take the case of teaching bias or style. A number of styles of teaching have been suggested (Bennett: formal vs. informal, Broudy: didactics, heuristics, philetics, The Department of the Air Force: presentational, verbal-interactive, application, Flanders: direct-indirect, Joyce and Weil; social interaction, information processing personal sources, behavior modification, Withall: teacher-centered, Pupil-centered). (See e.g., Kleine, 1982.) Given a teaching bias, such a heuristic or discovery style, the "concrete" variety of instructional alternatives both real and modeled seem to have great utility. Considerable logical thought needs to be given the task of matching instructional alternatives with teaching biases.

Figure 2.

INSTRUCTIONAL ALTERNATIVES AVAILABLE FOR USE IN TEACHER SEEN AS FUNCTIONS OF (1) TYPES OF EXPERIENCE AND (2) USE OF REALITY.

TYPES OF EXPERIENCE (CONCRETE TO ABSTRACT)	CONTEXT OF EXPERIENCE (REAL OR MODELED)	
	REAL REALITY IS USED	MODELED A MODEL OF REALITY IS USED
	THE TEACHER EDUCATION STUDENT LEARNS THE ABILITY CONCRETELY IN SITU. - TEACHING	THE TEACHER EDUCATION STUDENT LEARNS THE ABILITY WHILE ENGAGED WITH A MODEL OF REALITY. - MICROTEACHING - REFLECTIVE TEACHING - SIMULATORS (ICSL, TPL) - SIMULATION GAMES/ROLE PLAYING/SKITS
	THE TEACHER EDUCATION STUDENT LEARNS THE ABILITY VICARIOUSLY FROM REALITY OR A RECORDING OF REALITY. - OBSERVING REGULAR OR DEMONSTRATION TEACHING - OBSERVING OR LISTENING TO RECORDINGS OF TEACHING (PROTOCOLS) - DOCUMENTARY FILMS - STILL PICTURES - BOOKS, NON-FICTION	THE TEACHER EDUCATION STUDENT LEARNS THE ABILITY VICARIOUSLY FROM A RECORDING OF A MODEL OF REALITY. - FILM, FICTION - BOOK, FICTION
ABSTRACT THIRD-HAND	THE TEACHER EDUCATION STUDENT LEARNS THE ABILITY ABSTRACTLY WITH LITTLE OR NO ACCESS TO OR USE OF REALITY OR A MODEL OF IT. EMPHASIS IS MAINLY ON VERBALLY COMMUNICATING THE CONCEPT, SKILL OR ATTITUDE. - ACADEMIC CONTESTS OR COMPETITIONS, BRAINSTORMING, CASE STUDIES, COLLOQUIA, DEBATES, DISCUSSIONS (GROUP, PAIR), LECTURING, ORAL REPORTS, PROGRAMMED/CL, PROJECT-GROUP ACTIVITIES, RECITATIONS, SURVEYS-INTERVIEWS, SYMPOSIA, TEAM (COLLABORATIVE) LEARNING, ETC.	

Learning outcomes generally have been accepted, after the work of Bloom et. al. (1965), to fall into three domains: cognition, affect, and psychomotor. A critical, unanswered question presented rhetorically here is, Which alternative or alternatives is or are most likely to beget desired results in each learning domain? Take the need to help students of teaching acquire effective teaching behaviors such as clarity of presentation.

Finally, the choice of instructional alternative partly is a function of class size. Large classes are lectured to for a very good reason. Additional considerations that prompt attention to the attributes of instructional alternatives also include: the nature of the content of instruction i.e., whether, after Phenix (1964) it is symbolics, empirics, esthetics, synnoetics or synoptics; the nature of learners and, of course, available time.

Thus a series of question need to be framed when determining the utility of available ways of teaching teachers. (See Strong, Silver and Hanson, 1986.)

Laboratory and clinical experiences as subsets of instructional alternatives with special implication for professional preparation.

Professional practitioners require a high level of both knowledge and skill obtainable both on campuses and in field settings. In order to gain such, professions require novices to engage in series of significant laboratory and clinical experiences: laboratory experiences being those whereby novices ply their trade under the watchful eye of more skilled persons who provide them with feedback, i.e., reactions to their practice, and engage them in reflection on it; clinical experiences being those whereby novices engage in diagnostic and prescriptive activities associated with their work, again under the eyes of mentors. Perhaps best-known laboratory and clinical experiences are associated with the preparation of medical doctors, namely the internship and residency. Upon graduation from medical school, doctors serve at least a year as a hospital intern examining patients and prescribing treatment while supervised by experienced doctors. Should doctors wish to specialize, they additionally train for a year or more as a hospital

resident where they work with special patients. Like interns, residents learn through laboratory and clinical practice.

In the context of teacher preparation, student teaching usually is perceived to be the norm for laboratory-clinical preparation. Unfortunately, student teaching may not meet the definitions of either laboratory or clinical experience since it often approximates trial-and-error learning in that, as with Professor Thorndike's cats, it generally takes quite a few trials for novice teachers frequently left to their own devices to discover something for themselves. Thus student teachers often engage in irregular, hit-or-miss behavior as in the case of handling classroom miscreants.

Feedback is an essential element of efficient learning that must be present and only true laboratory experiences provide it. Feedback most easily can be provided when someone has the preparation and time to do so. Regrettably, K-12 cooperating teachers, through no fault of their own, may have neither.

The point is that valued laboratory and clinical experiences must accompany teacher preparation much as they do the preparation of other professionals. The observation is that student teaching may be, but often is neither laboratory nor clinical-like. The question is, How can it be made more so and what other instructional alternatives may provide such? In answer to the former, student teachers must be given considerably more attention by way of providing reactions to and opportunities to reflect on their performance and more supervised diagnosis of and prescription for pupil shortcomings. In answer to the latter we need only look to the conceptualization of available instructional alternatives to identify candidates that have the potential for providing practice with feedback, namely any of the concrete experiences both real and modeled. Thus, as defined herein, we can utilize teaching in natural classrooms and Microteaching, Reflective Teaching or selected simulations occurring in contrived settings.

Certainly other alternatives are or may be laboratory or clinical-like. Take use of case studies as a clinical approach. They may suffice if they provide opportunity for diagnosis and prescription of activities associated with the novice's work as

opposed to case studies of another's situation.

Conclusions.

Teacher educators must be aware of and skilled in the selection and use of instructional alternatives available for use in teacher education. Moreover, if teacher education is to be considered professional education it must especially and properly utilize valid laboratory and clinical experiences. Valid laboratory-clinical experiences engage novices in the practice of teaching. The critical question is what should novice teachers practice? Perhaps some clues can be derived from existing on-campus forms. Microteaching assumes the need to practice essential technical teaching skills such as set induction, stimulus variation, use of examples and planned repetition. Reflective Teaching assumes that novices should be given opportunities to teach, to determine the extent to which pupil learning and satisfaction follow and, most importantly, to give thoughtful consideration to the processes of teaching and learning. Selected simulations accept that novice teachers be aware of and skilled in solving classroom problems.

Other clues derive from the literature. For example, Berliner (1985, p.7) argues forcefully that "pedagogy must change to a laboratory based field of study wherein students of teaching can be trained in the behaviors needed in a professional person's repertoire." I would add that in addition to being trained, as Berliner suggests, to emit specific behaviors related to teacher effectiveness such as clarity and enthusiasm, they must also successfully evidence higher-order thinking skills such as analysis and problem-solving.

Interestingly available on-campus laboratory experiences are not well-used. It remains to be determined why promising laboratory or clinical instructional alternatives, utilizing "concrete-modeled" experiences such as Microteaching, Reflective teaching and simulations, described fully elsewhere (Copeland, 1982, Cruickshank, 1985), are underemployed.

Why is the "missing link" (Nolan 1982) missing? Once the answer to that question is determined and if the issues and problems associated with it can be resolved, then efforts can certainly be taken to

encourage and support the use and development of a wider variety of carefully selected instructional alternatives that are requisite to the preparation of professional educators.

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The Role of Interactive Video
in the Acquisition of Teaching Skills
Laurence D. Brown
David H. Gliessman
Indiana University, Bloomington

Teaching is based in interpretation. Any deliberate act of teaching derives from an interpretation by the teacher of pupil behavior or of his own behavior. This is another way of saying that the act of teaching is conceptual, that it is moored in concepts about what is being taught, to whom it is being taught and for what purpose. This proposition leads to a further one: skillful teaching is based in skillful interpretation. That is, the timely use of an appropriate skill derives from a perceptive interpretation of behaviors and events.

Evidence for the latter proposition can be found in two studies that have compared differences in the interpretive behavior of (1.) more and less successful and (2.) more and less experienced teachers. In an attempt to account for the comparative effectiveness of more and less successful student teachers, Doyle (1977) noted that among other differences the more successful teachers sorted or "chunked" events and behaviors in the classroom into relatively few categories that they then differentiated and reacted to in terms of their practical significance. This suggested that these student teachers were undergoing "... a concept formation process during which they learn[ed] to classify classroom events..." "The less successful teachers, in contrast tended to react to events and behaviors in isolation, failing to attend to the full panoply of stimuli in the classroom."

In a study of comparative decision-making between experienced teachers and inexperienced student teachers, Hutchins (1986) confirmed the findings of two other investigators that the two groups of teachers responded to quite different concerns or problems. The experienced teachers were observed to show concern most often for pupil learning while the inexperienced teachers attended more often to aspects of pupil behaviors and attitudes that had implications for classroom management. If one can assume some difference in skillfulness between experienced and novice teachers, a reasonable assumption, then these findings are quite consonant with the findings of Doyle's study in suggesting that interpretive behavior is a distinguishing characteristic of skillfulness.

Having reason to hypothesize, then, that interpretive skill is basic to skill in performance, we are faced with the problem of identifying a model of interpretation that can become the basis for training. One possibility is to look to the field of clinical psychology for such a model. One author, Levy (1963) defined psychological interpretation as follows:

"...psychological interpretation, viewed as a behavior, is engaged in whenever a state exists that seems refractory to other efforts at mitigation or understanding. In essence, it consists of bringing an alternative frame of reference, or language system, to bear on a set of observations or behaviors..."

Our objective, of course, is to train teachers, not clinical psychologists, yet there are several parallels. An act of interpretation is appropriate whenever a situation occurs in a classroom that "seems refractory" to a teacher's usual techniques. An alternative way of perceiving the situation, that is an alternative "frame of reference" or an alternative "language system", is needed, and the initiating data are student behaviors and teacher's observations of them. The language systems available to the clinical psychologist include that of Freud, for example, or Jung, or Carl Rogers, or a multitude of others. All would perhaps be from within the field of psychology. Teachers are not so restricted in their interpretative language. Their language of choice could be educational philosophy, sociology, pedagogy, perhaps even common sense. We would like to see concepts from educational psychology among the alternatives to which they could turn.

The clinical psychologist's interpretive behavior occurs during clinical interviews and is based on the behavior and language of the client and, perhaps, psychological test data. The teacher's interpretive behavior occurs in classrooms while teaching subject matter and some problem begins to emerge, perhaps in a student's behavior or the groups understanding of what is being taught. She must rely more on passive observation, observing reactions to questions, interaction among students, clues from homework and tests, etc. Out of these kinds of data her interpretations are born, expectations are developed, and problem solutions are generated. The literature in education best attesting to the significance and

ramifications of teacher's psychological interpretation is that on teacher expectations (Biddle and Anderson, 1986).

A parallel between our own analysis and that of Smith will be evident to anyone familiar with his seminal book, Teachers for the Real World (1969). Smith saw that the primary task of training was to develop interpretative competence, that skillful interpretive was dependent upon the availability of productive concepts and that interpretive competence could best be developed by confronting the trainee with protocols of classroom events and behaviors that required interpretation. Through the use of protocols, trainees could learn to interpret events and behaviors using concepts from the social, psychological, pedagogical and other domains. Interpretive skill would then, Smith said, provide the basis for performance skills.

Can interpretation be taught? There is evidence that concepts referring to the behavior of teachers and pupils can be acquired through the use of filmed protocols, that the presence of clear examples is associated with concept acquisition, and that the acquisition of concepts about teacher behavior is positively and significantly correlated with use of the referent behaviors in teaching (Gliessman and Pugh, 1978). A recent exploratory study by Verloop (1985) adds interesting evidence on the development of interpretive skill. This investigator formed three groups of elementary teaching models from Joyce's and Weil's (1980) Models of Teaching while a third served as a control. The two training groups received instruction in the elements of both models, one group with videotaped examples (video/model) and one group without examples (model-only). The video/model group showed a significantly greater mean use of the model elements than either the model-only group or the control group. Furthermore, the video/model group members reported thinking significantly more often about the model elements while teaching. These results provide particularly clear evidence of (1.) the effect of visual examples on both concept and skill acquisition and (2.) the mediating function of acquired concepts.

While confirming evidence does exist, however, the task of developing interpretive skills is complex. It is often necessary to acquire the skill while at the same time learning the language of interpretation. If psychological interpretation can be considered

a cognitive skill, J. R. Anderson (1982) would suggest that the sequence of acquisition process begins with the acquisition of declarative knowledge followed by gradual and slow reorganization and compilation into procedural knowledge. The sequential aspect of his theory is largely an untested assumption of his theory, not an empirical finding. Our view is that a general skill of psychological interpretation can gradually be acquired through the accumulative effect of learning a variety of individual or small sets of psychological concepts in an interpretive context.

We are not prepared to argue at this point that all significant concepts in educational psychology can or should be learned in this manner but many can.

What does it mean to learn concepts interpretively? There seems to be no obvious answers, but there seems to be little reason to depart drastically from current thinking on concept acquisition. For example, the principles for the teaching of concepts gleaned from the research in a review article by Tennyson & Park (1980) are relevant and have guided us in constructing our materials. Such considerations have been useful as analyzing the content structure, defining concepts in terms of attributes, choosing examples, and organizing and presenting them with feedback. The problem, for us, became apparent at the third step, choosing examples. Where is the concept formation research that focuses on psychological concepts? Are these concepts really no different from concepts in any other field?

Even a cursory study of the research shows a focus, perhaps a fixation, on class nouns as the primary kinds of concepts to be learned. In preparing this paper, to be sure we were current, we searched DIALOG, PSYCH INFO, TELENET, & PSYCH LIT for research on the teaching and learning of psychological concepts or behavioral concepts and found very little. The few examples using psychological concepts, one by Tennyson (1985) incidentally, used written examples. Several articles appeared in the journal, The Teaching of Psychology. None was research although we did find several useful techniques for teaching psychological concepts often involving written cases, but sometimes films or tapes. Nonetheless, it seemed the most defensible way to proceed was to base the teaching of psychological concepts on the conventional concept function literature, substituting for the verbal or

figural examples typically used, the behavioral examples needed.

The realization that exemplars of psychological concepts (and other kinds as well) are both needed and difficult to present in conventional classrooms is as old as the discipline itself. The proposed answers have been many and varied. When we were beginning our careers, the use of films, field trips, and written case studies dominated, although videotape was just emerging as a possibility. We found problems with all available forms. Films we rejected because most included narration which rendered it unnecessary or superfluous of students to engage in interpretation. We tried turning off the sound to only discover that the film had been designed as an illustrated lecture and had little meaning without the lecture. We tried case studies to learn again what Levy (1963) emphasized that psychological interpretation essentially involved "bringing a language system to bear on a set of observations or behaviors". Case studies devoid of an interpretive language system are extremely difficult to find or construct. Videotape technology at that time was extremely expensive and of questionable quality although its potential was obvious.

Our solution at the time was to produce films. We produced three kinds. One was a set of brief films which tracked a student through series of episodes during a school day, recording as much behavioral data as we could. A second series filmed fifteen individuals of different ages, intelligence levels, and handicapping conditions of vision and hearing performing eight cognitive tasks, a total of 120 scenes. Spliced together in different ways, films were produced which showed individuals performing different tasks or films which contrasted performance by age, intelligence or handicapping condition, to show all conformations of individuals and contrasts, 47 films were required. These films were meant to show raw behavior to students who were to engage in psychological interpretation. Instructors could then provide specific language systems or concepts for use in interpreting the recorded behaviors. The third type of films presented classroom problems, ones which could be developed in a dramatized presentation, in film of ten to fifteen minutes in length. When the problem was fully set, the film ended. The purpose was to create a situation lacking closure and encouraging interpretation and problem solving. Again the

instructor was presumed to provide the frame of reference for interpreting and solving the problems.

Both types of films worked reasonably well in terms of student attitudes and their improvement in interpretive and problem solving skills and their knowledge of the specific concepts used to interpret the films. Yet there was an inefficiency in the use of the films if the focus was not on the general skill of interpretation, but on the teaching of a specific concept. In a particular film of twenty minutes there might be five or six brief episodes, totaling perhaps five minutes, which were relevant to the specific concept. For that purpose the films were clearly not efficient. Stopping and starting the projector to find relevant scenes was unwieldy, and cutting and splicing film was destructive.

You can see where we are heading. Obviously interactive video could solve several of the problems inherent in our production venture and our educational objectives of several years ago. The 47 films could be reduced to one by putting the 120 brief scenes on a single tape or disk and writing computer program of different sequences. In addition, we intended that the various films serve generic purposes, that is different language systems, or different psychological concepts, could be used to interpret the behavior. Employing interactive video technology permits us to record the behavioral data on the tape or disk and developing the conceptual systems for interpreting the behavior on floppy disk. The system becomes remarkably efficient and versatile by contributing both to the acquisition of general interpretive skills and teaching a variety of specific psychological concepts at the same time.

The Current Prototypes

At this point we have two prototype units developed. Both are based on existing film footage. One is entitled, "Observing Student Behavior" and focuses directly on interpretive skills as defined in this paper and uses the concepts of need achievement, sociometric status, and scholastic ability as the language of interpretation. The other unit is directed at teacher problem solving and uses a specific model of problem solving as the vehicle of interpretation. The end point of the first unit is understanding the concepts, and accurate interpretation of the behaviors of a student in terms of the concepts. The second prototype asks the student to go beyond interpretation

via the problem solving model to the point of proposing solutions to the problem. Together the amount of time required to complete the two units is three to four hours.

The hardware used consists of Apple IIe computers, and Panasonic Model 6200 VCRs coupled by means of a BCD board. The authoring language was Superpilot. Choices of hard and software were based on pragmatic considerations of cost, availability and the experience of technical personnel. We claim no expertise in any of these matters.

The level of interactivity, in the current language of interactive video is somewhere between level III and level IV. The programs are designed to provide considerable user control over the sequence which is necessary for level three, but the system may lack sufficient components to be considered level IV.

The format of the "Observing Student Behavior" unit is as follows: The three concepts of need achievement, sociometric status and scholastic ability are listed in a menu. The student chooses one. The student to be observed is then introduced via video and the student is asked if she wishes to see the entire film or not. If not, the concept is defined generally and behavior indicative of high and low levels of the concept are listed. The task of the student is to rate the level at which the concept seems applicable to the filmed student on a five-point scale. A brief scene is shown then a rating scale is displayed requesting a response. If the student response agrees with the key, she is so informed and given choice of a) proceeding to the next scene, b) seeing an interpretation of the scene c) reviewing the definition or d) seeing the scene again. If the student rating is a single category from the key, she is so informed and the interpretation automatically appears followed by a screen of the four choices previously listed. If the student's response is more than one category from the key the scene is automatically replayed, and the student is then presented the same four choices. If the student's responses agree with the key plus or minus one category, for four scenes she is given the choice of continuing or moving to the next concept. At the end of the three concept lessons there is a test in two parts. Part one is verbal and focuses on definitions and written descriptions of behaviors related to levels of the three concepts. The second part is an

applicational test where the concepts are used to describe another student.

The program stores responses to both the learning and testing phases of the program on the disk. Students are asked to record their own time and respond to a set of Likert type attitude scales when the session is completed.

The Field Test of "Observing Student Behavior"

The setting intended for the interaction video unit was and is a one-credit hour field experience which accompanies the educational psychology course for secondary teacher at Indiana University. The field experience may include "laboratory" exercises as well. Data were obtained from students from two sections who had been randomly assigned to one of three groups; one which received the program as described earlier; one which received an "adaptive" version that permitted the option of advancing to the criterion test at any time; and a control which received the criterion test followed by the program. The key independent variables were two degrees of "learner control". Data consisted of lesson time and test time for treatment groups, lesson scores for treatment groups, test scores for all groups, and attitude measures for all groups. Some key results are displayed in Table I, and while not particularly interesting from the standpoint of the independent variables, do provide support for some essential program features. Sufficient students took advantage of the adaptive feature of the flexible program to produce a significant difference in the time spent on the program. Learning did result from the program as evidenced by the test score results,

Table I

Results of Field Test of "Observing Student Behavior"

	Time on Test	Time on Lesson	Lesson Score	Test Score	Attitude Total
Prescriptive Program	21.6	74.2*	3.1	14.0**	3.73
Adaptive Program	23.9	62.7*	2.9	14.5**	3.55
Control	X	X	X	11.2**	3.55

* $t = 2.36$, $p < .05$

** $F = 12.8$, $p < .001$ with 2, 56 df

and the average of the sum of all attitude scales is well above the theoretical mean of a five-point scale. Comments on the medium of interactive video and the perceived usefulness of the program, together with the attitude scores, are seen as sufficiently supportive data to judge this unit of instruction as moderately successful.

Next Steps

From the present focus on interpretive skills concerned with pupil social, motivational and academic variables and decision-making skills, we will, during the remaining two years of the project, focus upon explanatory behavior as a dimension of direct instruction. Based in part upon a research project concerned with the explanatory behavior of experienced teachers, we are in the process of identifying the variables that distinguish more and less comprehensive explanation. As these variables are pinpointed, we will plan the topical and pedagogical content of a series of videotapes to be programmed for interactive video. The objective will be to construct a training package that will clarify the characteristic that typify "good" explanation (i.e., explanation that is comprehensible).

Videotape footage of episodes involving explanation will be filmed in actual classrooms. Our intention is to sample the four curriculum areas of social studies, mathematics, science, and English over three grade levels (8,10, and 12). The results should be from 24 to 36 instructional episodes, averaging five to ten minutes in length. Altogether, approximately three hours of footage should result, sufficient for a very large number of interactive video instructional units for demonstration purposes. At the time that the videotape footage is being produced, progress on the general framework of the instructional computer program can be made, although completion of the program obviously will depend upon the availability of the specific videotaped episodes to be used.

After the completed videotapes become available, the computer software for the interactive video units will be completed. The objective is to complete three demonstration units for testing. One unit, appropriate for a general methods course, would sample teaching episodes over both grade levels and curriculum areas for analysis. Two demonstration units would be designed for specific methods courses with teaching episodes sampled over grade levels and teachers, but within a single curriculum area.

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Creating a "Recycling Center"
for Teacher Thinking
Greta Morine-Dershimer
Syracuse University

In a preservice course on Strategies for Secondary Teachers at Syracuse University, we prepare teachers to use alternative "models of teaching" (Joyce & Weil, 1972). When I teach this course I introduce each model by teaching a demonstration lesson with the prospective teachers as students. In demonstrating the synectics model, a strategy designed to increase creative thinking and problem solving ability, I typically engage students in generating analogies for the teacher. The lesson begins with the open-ended question, "The teacher is like what machine?" Working with various analogies through the several phases of the model, students conclude by describing the teacher in terms of some imaginative new analogy, thereby revealing both positive and negative aspects of their images of teaching.

Some very interesting analogies have been generated in these lessons. For example:

1. The teacher is like Niagara Falls because there is so much potential power, but only a little of it gets harnessed to produce electricity;
2. The teacher is like a snowflake because everyone is unique, and they have to have the proper climate or they'll melt away; and
3. The teacher is like a matchstick because it's kept in a box, it's needed by everyone at some time, it can be bought cheaply, and the important stuff is in the head.

The title of my paper is taken from one of these student-generated analogies: The teacher is like a recycling center because we contribute to the survival of our natural resources (children) by taking old bottles (concepts), breaking them up, and making new ones.

This image of the recycling center as a place where ideas are transformed and thinking is reshaped is a useful way of describing what we are attempting to accomplish in developing computer simulations for

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training prospective teachers in preactive decision making. Therefore, giving due credit to my students, I am borrowing (or recycling) their analogy, to talk about our project as creating a "recycling center" for teacher thinking.

The development project in which we are engaged has been financed by the Fund for the Improvement of Post-Secondary Education (FIPSE). We are beginning the second year of a two-year project, so it is appropriate at this point to reflect on our goals, review our accomplishments, and describe our difficulties. Hopefully, others may learn from our experiences.

The Immediate Environment

To understand how our recycling center operates, you must understand the immediate environment in which it is located. The preservice teacher preparation program at Syracuse University is based on the theme of "teacher as decision maker." Each course in the core sequence emphasized particular personal and professional decisions that prospective and practicing teachers must be prepared to make. Most of these courses include field experiences, which provide real settings in which decision making can be practiced.

The introductory course in the sequence, called Study of Teaching, places students in public school classrooms for directed observation. The personal decision to be faced by students in this course is, "Do I really want to be a teacher?" The professional decision to be faced is, "What do I need to know about how pupils respond to particular teaching techniques, and how can I best observe those responses?"

The concluding course in the sequence, called Teacher Development, occurs in conjunction with student teaching. The personal decision faced is whether to continue in teaching, and if so, what kinds of positions to seek. The professional decision considered involves weighing their strengths and weaknesses, and determining what to do for further improvement. This course is designed to impress students with the idea that teacher education, or professional development, is a life-long exercise.

In between these two courses our prospective teachers participate in a series of foundations and methods courses, all of which involve field experiences

and consideration of important personal and professional decisions. Field experiences are arranged through two teaching centers which the university operates in conjunction with local school districts. The directors of these centers are employed half time by the school district and half time by the university. The centers provide inservice training for teachers in the districts as well as field experiences for our preservice students.

This is the immediate environment, or program context, within which our recycling center has begun to operate. The first set of computer simulations were developed for use in the second course of our core sequence, called Personalizing Teaching and Learning. In this course students are introduced to the view that behavior is a function of interaction between the person and the environment. They are involved in deciding what instructional environment will promote the best learning for pupils of different abilities and learning styles. Much of the content in this course is based on the theory and research of David Hunt of the Ontario Institute for Studies in Education (Hunt, 1971).

The Larger Ecological System

The Personalizing Teaching and Learning course is not the only one that draws heavily on theory and research on teaching and learning. In effect, research on teaching forms the larger ecological system within which our program and our recycling center continue to evolve. In particular, research on teacher thinking has provided sustenance for the development of our ideas.

It is not my purpose here to review extensively the research on which our simulation is based, but I would like to briefly mention one ongoing study that has identified findings closely related to our project. Berliner and Carter (1986) have been conducting a series of studies of expert, novice, and postulant (aspiring but untrained) teachers at the University of Arizona. In a study of teacher planning their expert teachers differed from their novice and postulant teachers in several important ways. These are some of the characteristics exhibited by the expert teachers:

1. They merged information on individual students to develop a picture of the characteristics

- that typified the group they would be instructing;
2. They tended to disregard information left by the previous teacher, preferring to develop their own perceptions;
 3. They focused on information related to potential instructional problems, such as visual impairment of individual students;
 4. They focused more on curriculum issues than socioemotional issues in planning for instruction; and
 5. They made careful assessments of student knowledge and performance rather than merely identifying content previously covered.

According to Berliner and Carter these expert teachers operated from a storehouse of information, had clear images of how things ought to be, and exhibited reasoned thinking, citing evidence to support their inferences about students they were planning to teach.

Studies like this are important, for they help to pinpoint the types of expert thinking that we want to help our prospective teachers develop or emulate. We need more studies of this type. At the same time, we need studies that give us information about how to help prospective teachers develop the ability to think like experts. We know almost nothing about that process at present. One phrase that Berliner and Carter use is quite suggestive, however. They characterize these experts as operating from a "storehouse of information." (pg. 41). To me this suggests that a key part of the developmental process may be the accumulation of information that can only come from experience.

In our project to train prospective teachers in preactive decision-making, we are simulating experiences that contribute to such an accumulation of information. More importantly, perhaps, we are encouraging them to reconsider their decisions in the light of new information, which in effect forces them to consider the usefulness of different types of information. Thus, we hope that they are learning to separate the wheat from the chaff as they begin to stock their own storehouses of information.

The Recycling Plant

The basic machinery of our recycling center is

contained in a computer program dubbed STDm, for Simulation on Teacher Decision Making. The simulation involves a data bank of information on 4 elementary school children entering the fifth grade. The available information consists of their school records from kindergarten through fourth grade, and includes family backgrounds, standardized test records, IQ and creativity measures, teacher comments, report card grades, summaries of parent conferences, health and attendance records, sociometric data, individual interests, and samples of class work in writing and arithmetic. The information came originally from real school records, but care has been taken to ensure that the actual pupils cannot be identified.

This data bank was initially developed to design simulation tasks for a model elementary teacher preparation program at Teachers College, Columbia (directed by Bruce Joyce), and was subsequently used in simulation tasks in an alternative, field-based teacher preparation program at California State University, Hayward. It was also used to collect data on the planning of more and less effective experienced teachers in the Beginning Teacher Evaluation Study (BTES) conducted at the Far West Laboratory. Thus, in beginning to design our computer simulation we had some prior knowledge about what types of tasks might be most productive and what types of responses prospective and experienced teachers might make to these tasks.

Two new and important elements are involved in this reincarnation of our data bank of information. The first is the computerized system for storage and retrieval of information, and in this case the information includes more than the bank of data on elementary pupils. Our computer system also enables us to store and retrieve data on the decisions made by our prospective teachers, and the reasons they give to support these decisions. The second new element is the developing base of research on teaching. Much of the feedback we are now able to give students about the potential efficacy of their decisions derives from classroom research on effective teaching and on teacher thinking.

In selecting tasks for our first year of development, we concentrated on the types of decisions crucial in preliminary organization of the classroom, because these are the types of decisions our students

have no opportunity to rehearse during their field experiences. Furthermore, we focused on decisions that could be informed by research. The first two tasks involved decisions about the preliminary grouping of pupils for instruction in reading and the allotment of time for instruction. Let me describe these two tasks briefly before reporting on our students' responses to them.

Grouping for reading. In the Grouping for Reading task students are given photographs of the 14 pupils in the data bank, and provided with names, birthdates and family background data on these pupils (fathers' and mothers' education and occupation, and age and gender of siblings). They are told that they are expected to form reading groups for this class, presented with a menu of types of information available on these pupils, and invited to select two types of information to help them in making this decision. The computer prints out the information they select, and they take it with them to study as they decide about how to group their pupils. Because the decisions they are making are preactive decisions, we deliberately build in time for reflection on the information they have selected.

In session two students return to the computer and record their decisions. They indicate the number of groups they have formed, and the specific pupils assigned to each group. Then they write a memo explaining why they formulated their groups in this way, that is, what they hoped to accomplish and how they interpreted the information they received. At this point the computer prints out a third type of information, and asks them to study this and consider whether they want to revise any of their groups, based on this new information. The program is designed to give them a contrasting form of data at this point. If they have selected only test records, or more objective data, they are given teacher comments, or more subjective data, and vice versa. Again they take the information away to reflect on it and reconsider their decision.

In the third session students tell the computer about any changes they have decided to make in their reading groups, and explain why they have or have not made such changes, noting how the new information has contributed to their thinking. At this point the computer provides them with feedback. The relative

merits of the various types of available information are discussed, and possible "errors of measurement" associated with each are pointed out. Students are alerted to discrepancies in data about individual pupils (e.g., marked shifts in achievement test scores over the years, or differences between language and non-language scores on IQ tests), and provided with some possible explanations for these discrepancies. Finally, they are given a probable "best placement" for each pupil based on an experienced teacher's analysis of a combination of test records, teacher comments, and report card grades. They are asked to compare their placements to this "best" placement, noting whether they have placed pupils above or below their presumed potential. The consequences of these two types of errors are discussed.

In concluding the third session, and the task, students write a memo indicating their reaction to the feedback. Again they are asked whether they would change their decision based on this additional information.

Allotting time for instruction. In the Allotting Time for Instruction task students are asked to plan a weekly schedule for their entering fifth grade class of 30 children, which includes the 14 pupils in the data bank. They are presented with certain constraints, in that four special subjects (music, gym, library, and art) are scheduled first period of the day for their class, each meeting one day a week. Also, some children will be leaving their classroom half an hour early for special activities (church school, band, chorus) that each met one day a week. The school day lasts from 9 to 2:30, and lunch is scheduled from 12 to 12:30. The weekly schedules of two other, experienced fifth grade teachers in the school are available if they want to examine them.

Students take this information away and develop their plans for a weekly schedule of classes. In the second session on this task they report their general schedule to the computer, noting specifically the number of hours per week scheduled for each subject area. They write three memos explaining their plans for scheduling instruction for reading groups; for organizing the class for instruction in math; and for scheduling activities during the three afternoon periods when only part of the class will be present.

Students are then presented with feedback that

focuses on issues of the effectiveness of whole class vs. group instruction, based on research on academic learning time and classroom management. The importance of active engagement (maximized in teacher-led instruction) and instruction at the appropriate level of difficulty (maximized in ability grouping) are both emphasized, thus highlighting the balancing act teachers must perform in scheduling for instruction.

Alternatives like peer tutoring are introduced as possibilities to consider. Also, students are given a proposal from Mrs. Collins, another fifth grade teacher, to team up for instruction in reading and math, in order to form larger, more homogeneous groups for instruction in these basic skills. Students respond to these suggestions in a final memo.

Reshaping Student Ideas

During the spring semester of 1986 twenty-three elementary education majors who were enrolled in the course on Personalizing Teaching and Learning worked with these computer simulation tasks. All twenty-three completed the first task, "Grouping for Instruction in Reading". Eighteen completed the second task, "Allotting Time for Instruction," as well. In general, student reactions to the simulations were quite favorable. The following comment, taken from a student memo, is not atypical:

I found this exercise to be a wonderful experience. I found myself captured into not only the life of the student, but also the life of a teacher - both of which I found to be very exciting.. I enjoyed this experience and I am glad I had an opportunity to do it.

Of course, since this was many students' first experience with a computer, and they worked with our program in the first stages of its development, there was some frustration with the vagaries of the computer, as well. Another fortunately less typical comment was:

I am writing this after a particularly frustrating experience when I attempted to complete the simulation with Session III..... the computer kept typing errors and not what I was putting in. It would type letters on the screen that I had not typed and then insolently suggest that it had received the incorrect command.....

As noted earlier, one of the purposes of the computer simulation was to encourage our elementary education majors to rethink their decisions as they accumulated information. For example, in the grouping for reading task, they selected two types of information on the "data bank" students, and organized reading groups on the basis of that information. They were then fed one additional kind of information selected by the computer. For the most part participants selected more subjective types of data initially (teacher comments, reports of students' special interests, report card grades), and were later given more objective types of data (standardized achievement test results, IQ and creativity test results).

In general, students did revise their initial decisions to some degree after receiving additional data. Eighteen of the twenty-three preservice teachers formed reading groups based on pupil ability. Two thirds of them changed their assessments of the ability of several of the "pupils", after receiving more objective data. Table 1 shows that for the most part the revised decisions led to more appropriate placement of the data bank pupils. It also shows that "errors" in initial placement tended to involve an overestimation of pupil ability. It is heartening to note that this overestimation occurred for Bob, a black foster child, and for Jane, an Asian child from a low SES family, as well as for Ira, Joe, and John, all of whom are non-minority, high SES pupils. Our prospective teachers did not appear to expect lower achievement from minority and lower SES pupils.

The research-based feedback that participants received in the initial version of the two simulation tasks tests so far was general information, not keyed to their specific decisions. In neither task was the feedback totally effective in changing our preservice teachers' beliefs about the value of certain instructional practices. But such total effectiveness is probably impossible to achieve. The feedback did apparently influence many of the participants.

On the grouping for reading task, five participants grouped the data bank students heterogeneously and noted that they wanted to focus on social development of pupils during reading group instruction. Of these five, two prospective teachers change their intentions after feedback, and said they would change to homogeneous ability grouping for reading, but specified

that they continued to have social development of pupils as an important goal in their overall instruction. The remaining three prospective teachers indicated that they disagreed with ability grouping on principle, and that the feedback had not altered their position. A few participants disagreed with the weight given to standardized achievement test data, and noted that they considered teachers' judgements to be much more valid than test results. One third of the participants reported that they had learned a great deal about the appropriate use of the various types of data, and gave specific examples of how they would use such data in the future. Half of them noted that the feedback had reinforced both their decisions and the process that they had used in weighing information, and suggested that they would feel more secure in making real classroom decisions as a result.

On the allotting time for instruction task, which focused more on organization for instruction in mathematics, only five of the eighteen participants planned to group for the instruction in mathematics. There was little carry-over from the first task, for they seemed to assume that the data bank students would mostly be of average ability in mathematics. Although they all had achievement test data showing varied performance of these pupils (received during the grouping for reading task), almost none of them expected highly varied performance in mathematics. Of the thirteen participants who initially planned for whole group instruction in math, six continued to reject the idea of grouping in mathematics after receiving feedback.

There was somewhat more carry-over of the first task in decisions about allotment of time for reading instruction, and feedback also seemed to be more effective. Seven of the eighteen participants planned initially to provide more time for instruction of low ability readers than for high ability readers. Eleven did not. Of these eleven participants, all but two revised their original plans after feedback, acknowledging that lower ability students would probably benefit from more teacher-directed instruction.

With regard to a third issue inherent in the time allotment task, most participants initially planned "free time" or non-instructional type of activities for the three class periods per week during which certain pupils would be leaving the classroom for special activities (religious instruction, band,

and chorus). After feedback, many of these prospective teachers indicated a better understanding of the benefits of active learning during these periods. Six planned to provide time for peer tutoring. Four planned to provide individualized seatwork, so that students could practice skills needing improvement.

Retrofitting the Center

As a result of the trial runs of the first two simulation tasks, we have learned some interesting things about the knowledge, attitudes, and beliefs of the elementary education majors who participated. In addition we have learned what kinds of revisions need to be made to improve the effectiveness of the simulations.

Sharpening faculty perceptions. The responses of participants to the computer simulation tasks, particularly the memos they wrote, revealed much about their knowledge, attitudes, and beliefs. This demonstrates that the program can collect data on teacher education majors that will be useful to teacher education faculty for purposes of program evaluation and improvement. This contribution of the program to faculty understanding of student beliefs is as important as any contribution it may make directly to student learning. For these particular participants, the following information is being passed on to teacher education faculty at Syracuse University.

1. Many students did not know how to interpret standardized test scores, or IQ test scores.
2. Many believed that teacher perceptions about pupils' performance were much more accurate than objective tests.
3. Some believed that social development was a more important goal than academic learning, even in instruction on basic skills like reading and mathematics.
4. Many felt that mathematics should be taught by whole class instruction, even when pupils clearly varied greatly in ability.
5. Most believed that fifth grade reading groups, even low ability groups, only needed to meet with the teacher for 10-20 minutes

- at a time, and many believed that reading groups only needed to meet 2-3 times a week.
6. Most believed that fifth grade social studies and science should be taught in 30-minute periods.
 7. Many believed that more instructional time should be allotted for spelling than for composition or creative writing.

Many of these beliefs run contrary to the recommendations for practice derived from current research on teaching. However, the specific beliefs listed here are less important than the fact that beliefs such as these are revealed by responses to the simulations. Given this information, professors teaching methods courses in these various subject areas can adjust their courses to confront their students with evidence that disputes these beliefs.

Sharpening the simulation. A number of revisions in the simulations are planned as a result of the initial responses of participants. None of these are major revisions, but each should add to the effectiveness of the tasks. To begin with, we need to make feedback more specific to particular responses of the students. The following are some examples:

1. We plan to add a loop whereby users who need more information to understand test scores can exit to obtain that information, and then return to the task.
2. In feedback on the reading task, while discussing the values and problems associated with each type of data, we will differentiate between those who have and have not used the data, and include examples of the actual data, for those users who have not seen a particular type of data in their work on the task.
3. In the reading task, we will give special feedback to users who have given first priority to goals other than academic learning. We will present relevant research on why academic learning is an important goal in basic skills, and note other curriculum areas where social development might better be pursued.

In addition, some changes in general feedback will be made, as follows:

1. In the reading task, we will add information about research on teacher expectations, to counteract inflated beliefs about the accuracy of teacher perceptions, and over-reliance on teacher comments as a valid source of information.
2. In the allotment of time task, we will give data on achievement test scores in mathematics, in order to impress users with the large differences in pupil ability in this area.
3. In the allotment of time task, we will add information from research on the effects of ability grouping on student achievement in mathematics. We will differentiate between ability-grouped classes, which research suggests do not improve achievement, and ability grouping within classes for certain selected subjects, which research suggests does improve achievement.

Further work with the revised simulations during the second project year will provide us with information about any shifts in patterns of responses that might result from these revisions.

Circumventing roadblocks. As yet these revisions have not been made in the computer program because of unforeseen complications with the university mainframe. In May, 1986, the University switched from a DEC-10 to a VAX computer. This change was anticipated and we were prepared to make the small changes that would be required for our program to run on the new computer.

What we did not anticipate was that the LISP program would be revised at about the same time. The Simulation on Teacher Decision Making (STDM) program we are developing work in association with a program called QUALOG, and both QUALOG and STDM are based on LOGLISP, which is based on LISP. As a result of the revisions in LISP, LOGLISP stopped working, and this meant that neither QUALOG nor STDM would run. The developers of LOGLISP, who luckily are professors in the Syracuse University School of Computer and Information Sciences, have been working feverishly this summer and fall to reestablish that program, so that it would run on the revised LISP. QUALOG and STDM were finally revised to run on the new LOGLISP about two weeks

ago. Only now can we begin further programming.

This problem has led to a delay in our schedule for revising tasks 1 and 2, and for programming task 3, which will involve selecting instructional materials at the appropriate level for student ability. In addition all the analysis of participant responses to tasks 1 and 2 had to be done "by hand" from computer printouts collected in April, rather than by computer, using QUALOG, as originally planned. The analysis was much more time-consuming as a result. While this problem has resulted in some delay in completing specific project activities, we still expect to complete all our planned activities by the end of our second project year.

Taking Stock

Any recycling center must keep records on the materials that it collects and processes, and we recognize the need for this kind of quantitative record keeping to supplement our more qualitative analysis of changes in student thinking. In order to check the possible effects of the preliminary form of our simulation exercises, we conducted a statistical evaluation.

Eighteen elementary education majors completed the first two simulation tasks in the spring semester of 1986. All were enrolled in the Personalizing Teaching and Learning course. This course is taken by all students in teacher preparation programs at Syracuse, so other students in the course were prospective teachers, but not majors in elementary education. Because our teacher preparation programs are relatively small, we could not "match" students who participated in the simulation exercises with a comparison group who did not, except on the basis of gender. Therefore, seventeen female elementary education majors who completed the simulation tasks were compared with seventeen other female students enrolled in the same course.

Because this simulation focuses on teacher planning, an estimate of the planning abilities of the two groups of students was made early in the spring semester. Guilford (1967) has identified the sensitivity-to-problems factor as one of the most important and relevant for planning. This factor has consistently been elicited by a paper-and-pencil test called the Seeing Problems (Deficiencies) Test,

which asks respondents to indicate what is wrong with a number of described plans. This test was administered to all students in the Personalizing Teaching and Learning course.

The final measure of planning was embedded in a class examination administered at the end of the semester. It consisted of two vignettes describing two pupils. Students were asked to indicate what additional information was needed to plan for each pupil, and to note what problems a teacher was likely to encounter in working with them. Thus, the criterion measure tested general planning skills, rather than the specific skills covered in the simulation exercises.

In addition to these two tests, a measure of the academic performance of students was obtained. Scores on the first course examination, conducted at midterm, were used for this purpose.

The two comparison groups of students did not differ significantly on any of these three measures (see Table 2), although the simulation group of female elementary education majors scored lowest on all three measures. Analysis of variance, with the Seeing Problems Test and the academic performance measure as co-variables, also indicated that the two groups did not differ significantly in performance on the final planning task.

It is probably too optimistic to expect that the work on two tasks in the initial stages of development of a computer simulation on teacher planning would have a strong impact on the general planning abilities of prospective teachers, so we are not discouraged by these results. The revisions that we plan should make the two exercises tested so far more powerful, and the addition of other exercises to be developed this year should also increase the impact of the simulation.

One further note has to do with the role of the computer in this simulation. As a group, the elementary education majors who worked with the STD program had less prior experience with computers than any other students in the Personalizing Teaching and Learning course. In interviews these students revealed they feared the technology and associated it with the "quantification" of teaching. With all their fears, however, almost without exception these students reported that they viewed the simulation as a valuable learning experience, and one which should be available

to more students.

Another approach to evaluation of our simulation tasks involves comparing the responses of our students to those of other novices. The Berliner and Carter (1986) study is useful for this purpose. Our novices, like theirs, tended to be overly reliant on information about pupils provided by the previous teacher; tended not to seek specific information on physical characteristics that could affect learning, such as visual impairment; and tended to emphasize socioemotional issues in planning for instruction.

The feedback we have provided our students is designed to move their thinking more in the direction of that exhibited by Berliner and Carter's expert teachers. We have pointed out the potential problems of over-reliance on perceptions of previous teachers. We have noted the importance of checking health records of students for early identification of hearing or vision problems that could impede learning. We have emphasized the importance of academic goals for instruction in basic skills, while providing information about procedures like peer tutoring that can contribute to socioemotional goals as well. These feedback features were incorporated into our simulation before the results of the Berliner and Carter study were available. Thus, their results provide an encouraging validation for many of our early decisions.

Rethinking the Analogy

The image of the recycling center seems to be a useful one for the simulation project in which we are engaged. We are working to reshape some of the ideas and beliefs which, according to research on teaching, may need to be reformulated for effective teaching to occur. At the same time, our STDM program is gathering data on the thinking of these prospective teachers, and this information can be used to improve the assumptions that we teacher educators make about the knowledge and beliefs of our students. Thus, the planning of our faculty as well as our students may be improved when this simulation is revised and fully implemented.

By the same token, the ideas of the developers and evaluators are being reshaped as we work on this project. We have identified some necessary revisions in the STDM program, based on student responses.

We are also in the process of rethinking our method of evaluating the effects of the STDM program on our students. We may need a more direct test of the learning of specific skills addressed in the simulation tasks. Perhaps the best measure of the effectiveness of the recycling center we are creating is the fact that our own ideas are being reformulated in the process.

Of course, any analogy has its limitations, and it is important to note the ways in which this analogy does not fit the reality. For one thing, the ideas our students bring to the simulation tasks we have developed are not "used" ideas ready to be discarded. They are for the most part ideas which students have no opportunity to use in their field experiences, since they relate to planning decisions made by cooperating teachers before our students are ever assigned to the classroom. Without the opportunity to reexamine these ideas in a classroom simulation, they might well be implemented in the first year of teaching, with less-than-beneficial results for pupils.

Equally important is the fact that our simulation is not designed to "shred" or "compact" the ideas our students bring to it. Rather, as students use their ideas in this protected setting, and analyze their planning decisions in relation to feedback based on current research on teaching, they are extending and expanding the information they have available for future planning tasks.

More importantly, these students are extending and expanding the information that we have about their ideas. It is only by learning more about the planning principles of prospective teachers, and the ways these may change as experience accumulates, that we may eventually learn how novice teachers become experts. In the long run, this may be the most important contribution of the simulated experiences we are creating in our recycling center.

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TABLE 1
Patterns of Decisions on
Ability Grouping for Reading Instruction

<u>DATA BANK</u> <u>"STUDENT"</u>	<u>TYPICAL</u> <u>INITIAL</u> <u>DECISION</u>	<u>PLACEMENT</u> <u>SECOND</u> <u>DECISION</u>	<u>RECOMMENDED</u> <u>PLACEMENT</u> <u>("EXPERT" DECISION)</u>
*Bob	Average to Low	Average to Low	Low
Carson	Low	Low	Low
Ezther	High	High	High
*Ira	Average	Average to Low	Low
*Jane	High to Average	Average	Average
Jeff	High	High	High
Jim	Low	Low	Low
*Joe	High to Average	Average	Average
*John	Average to Low	Low	Low
Josee	Low	Low	Low
June	High	High	High
Neil	High	High	High
^b Robin	High	High to Average	High
*Ruth	High to Average	Average	Average

*--Change in appropriate direction.

a--Lack of change in appropriate direction.

b--Change in inappropriate direction.

Table 2

Mean Scores and Standard Deviations of 17 Simulation and 17 Comparison
Students on Seeing Problems, Planning, and Class Examination

Test	<u>Simulation</u>		<u>Comparison</u>		*tValue of Mean Diff.
	M	SD	M	SD	
Seeing Problems	7.35	2.68	7.59	2.87	.24
Planning	8.82	2.55	10.47	3.66	1.32
Class Exam.	27.35	9.34	31.88	11.75	1.21

*For df 32, $t = 2.02$ significant at .05 level.

Teacher Information Processing in the
Management of Classrooms
Willis D. Copeland
University of California, Santa Barbara

The identification and measurement of qualities in teacher candidates which predict future teaching success has been as elusive a goal for educational researchers as it is attractive. This paper reports the development and initial testing of project intended to verify a relationship between selected cognitive abilities (vigilance and multiple attention) and success in specific areas of teaching performance (classroom management). The results of subsequent testing are reported in Copeland (in press).

Over the past 15 years there has developed a body of ethnographic literature which pictures classrooms as extremely complex places (e.g., Smith & Geoffrey, 1968). These pictures push us to appreciate more and more the difficulties inherent in managing complex classrooms so that educational goals are achieved. Thus, the recent interest in classroom management (e.g., Duke, 1979).

Most recent attempts to translate research and thought on classroom management into forms usable by teachers have taken the form of recommendations. As examples, it is recommended that teachers adopt systems of time allocation and scheduling, strategies of grouping for instruction, disciplinary techniques, physical arrangements of such things as learning centers, media in classrooms, and a host of other systems which purport to increase the manageability of classrooms. Unfortunately, none of these recommendations produce consistent correlations with student learning. Instead, they are successful when used by some teachers under some conditions but fail when used under different conditions or by other teachers.

This paper suggests that providing recommendations to teachers may not be sufficient for insuring their success as classroom managers. It suggests that, in order to successfully use any such recommendations, the user (the teacher) must possess certain underlying cognitive skills, employment of which are required by the recommendation. Success in classroom management is thus seen not only to depend on teachers' knowledge of successful management techniques but also on teachers' possession of the cognitive skills necessary for implementing these techniques.

Kounin (1970) reported that he saw two such cognitive skills present in the successful classroom managers he observed. He called these skills "withitness" and "overlap". Cognitive psychologists have for some time been interested in phenomenon which they call "vigilance" (Buckner & McGrath, 1963) and "multiple attention" (Neisser, 1976) but which appear to closely parallel Kounin's description of withitness and overlap. Vigilance is defined as the ability to detect and react to more than one stimulus at once. Observation and measurement of these phenomena are commonly done by cognitive psychologists but never in educational settings. However, in classrooms vigilance could be observed, for instance, in the teacher's ability to recognize changes in individual students' behavior so that a judgement of the appropriateness of that change may be made. Multiple attention might also be observed, for instance, in the teacher's ability to monitor the behavior of different students as they engage in different learning activities concurrently. The hypothesis tested in the research reported herein is that successful classroom management is correlated with measurements of teachers' vigilance and multiple attention capabilities.

To test this hypothesis a microcomputer administered simulation was developed. Called "The Arithmetic Drill Game" here, this simulation engages a teacher/subject in the conduct of a variety of management activities which surround a drill-based learning sequence in an elementary classroom.

Kounin (1970) reported that, in addition to being related to managerial success, withitness (vigilance) and overlap (multiple attention) were related to each other. His partial correlational analysis revealed that, while withitness stood alone as a predictor of managerial success, correlations between overlap and managerial success were reduced to insignificance when the effects of withitness were removed. Because of this intertwining of effects, the Arithmetic Drill Game is designed to measure vigilance and multiple attention skills at the same time. Such a procedure provides a more appropriate measure related to behavior management in group settings than would scores from separate tests of vigilance and multiple attention.

The Arithmetic Drill Game tests withitness and overlap skills in a manner consistent with the classroom characteristics identified by Doyle (1979): multidimensionality, simultaneity, immediacy, and

unpredictability. To meet these specifications, five separate tasks were designed requiring vigilance, question production, and response assessment (multidimensionality) given to the subject (player) at the same time (simultaneity), while varying the tempo of the tasks (unpredictability). Records of performance include both correctness-of-solution and time-to-solution (immediacy).

The time required to administer this simulation is not long. Both preparation of the subject and administration of the test requires approximately 18 minutes, with an actual testing time of 10 minutes.

Tasks Presented to the Subject

The following description of the five tasks in the Arithmetic Drill Game includes the display of the task, the performance required of the subject, and the measurement obtained of that performance.

TASK #1 - Withitness

Display. A graphic depiction of the head and upper body of "Ian" (a pupil who has difficulty staying on task) sitting at a desk is displayed near the upper right corner of the screen. In Mode 1 Ian is looking down at a book held in his hand. The program changes the graphic to Mode 2 at predetermined times in the ten minute testing period; the change is such that Ian looks up.

Performance required of subject. The subject directs Ian to return to work by depressing the designated key on the keyboard.

Measurement of performance. The program records elapsed time between the graphic change and depression of the key by the subject.

TASK #2 - Problem Generation

Display. In the lower center of screen, a blank space where the subject may type is provided.

Performance required of subject. When prompted, the subject uses the keyboard to enter single digit multiplication problems (e.g., 4x3, 8x2).

Measurement of performance. The program records elapsed time between each repeated initiation of this task.

TASK #3 - Maintenance of Routine

Display. The program displays a graphic depiction of five pupils, labeled with names, sitting at desks.

After each completion of a Task #2 operation, the program will alter the graphics so that two, three, or four pupil raise hands, the exact number of hand raises to be predetermined for each item of the test.

Performance required of subject. The subject selects which pupil may respond to the teacher's question by depressing the appropriately lettered key. The subject is instructed to alternate volunteers and non-volunteers.

Measurement of performance. The program records (a) whether the selected respondent is a volunteer or a non-volunteer, and (b) whether this characteristic is the same as or different from that of the pupil selected as respondent to the previous question.

TASK #4 - Response Assessment

Display. The answer to the question entered as a result of Task #2 appears in the upper center of the screen.

Performance required of subject. The subject indicates his/her assessment of correctness of the response by depressing the "correct" or "incorrect" key.

Measurement of performance. The program records the correctness of the subject's assessment.

Because Tasks #2, #3, and #4 are sequential, and simultaneous with Task #1, they provide the subject with a meta-task characterized by Kounin's overlap.

TASK #5 - Situational Memory

Display. After completion of the 10 minute testing period the following four questions are asked:

1. "Which of the five pupils in the math group answered the most number of questions correctly?"
2. "Which of the five pupils in the math group answered the least number of questions correctly?"
3. "Which of the five pupils in the math group volunteered the most?"
4. "Which of the five pupils in the math group volunteered the least?"

Performance required of subject. The subject depresses the key of the selected answer for each question.

Measurement of performance. The program identifies the correctness of each of the subject's four answers.

Sequence of the Tasks Within the Game

Progress of the subject through the game is controlled by a series of prompts displayed on the screen. Following these prompts, the subject completes as many cycles as his/her speed allows within the ten allocated minutes.

If the subject makes any errors during the playing time, appropriate error messages are displayed. Thus, with prompts and error messages, the subject makes responses as rapidly as possible for ten minutes. After the allocated time has elapsed, a termination message is displayed, followed by the four questions which comprise Task #5.

Recording Data On Performance

After completion of the ten minute game and Task #5, data pertaining to the subject's performance is written onto a disk file labeled with the subject's ID number. This data includes (a) the number of problem cycles completed by the subject within the ten minute period, (b) whether the student selected (volunteer or non-volunteer) is different from the previous selection, (c) whether the subject's assessment of the pupil's response is correct (d) elapsed time between the student going off task and the subject depressing the appropriate key, (e) the accumulated score, (f) elapsed time for each problem cycle, (g) elapsed time between start of game and start of current problem cycle, and (h) the correctness of each subject's response to the four Task #5 questions.

A utility computer program is used to read data from this file and display it on a CRT Screen or end it to a printer. This utility program also offers a series of summary totals including number of correct volunteer alterations, number of correct response assessments, total elapsed time Ian was off task, number of times Ian was off task, average elapsed time Ian was off task, total score for ten minute playing time, score for questions in Task #5, and total game score. Thus, complete information on the player's performance is available for review at the completion of the game.

System requirements of The Arithmetic Drill Game

The Arithmetic Drill Game utilizes a set of software source programs written in Pascal by the author for the Apple II disk-based microcomputer. The major hardware component, the Apple II Language System, as well as one software package used by the system, are off-the-shelf items, permitting users

to concentrate on the system as a whole rather than on hardware assembly and testing.

System Hardware

The specific hardware configuration used for execution of The Arithmetic Drill Game's software is comprised of an Apple II Microcomputer with 64K RAM memory with two drives. The printer currently used with the system is a Malibu Electronics Corporation Malibu Printer, Model 165. It prints up to 165 characters per second and is connected directly to an Apple with an I/O card. The printer is used for program listings and reports based upon participant usage of the system.

The Arithmetic Drill Game requires that the system contain an "Apple Clock" which allows the computer to automatically enter time variables when applicable.

System Software

The Apple Pascal Version 1.1 was used to develop the computer software programs. This allows compatibility between machines and ease of programming new applications of updating existing routines. All the programs are initially written as "TEXT" files, but to be executed by the system they must be changed into "code" files by the Pascal compiler. These files are in "p-code", or code the Pascal interpreter can understand.

The software segment of the Arithmetic Drill Game System contain four main components: (a) instructions for playing the game, (b) the game, (c) a termination component which quizzes the player and gracefully exits the game, and (d) the utility program used for data analysis.

Preliminary Evaluation of the Arithmetic Drill Game

The two evaluation questions addressed were (a) "Is there a significant correlation between subjects' scores on the Arithmetic Drill Game and subjects' ability to demonstrate withitness and overlap skills while managing classroom-based group learning situations in the field?", and (b) "Does playing the Arithmetic Drill Game evoke in subjects' thought processes and emotions similar to those experienced by the subjects while managing classroom-based group learning situations?"

Subjects. To seek answers to these questions, 17 recent graduates of the teacher credential program at UCSB (3 men and 14 women) volunteered to play the game. No attempt is made to claim external validity

for this evaluation on the basis of this sample. The subjects did not represent any known larger population. They were, however, individuals who had completed, within the last month, an extensive 30-week student teaching experience in public elementary school into which students with special education needs had been mainstreamed. Further, data could be collected about their withitness/overlap abilities by utilizing their University supervisors as observers.

Data Collection. To answer the first evaluation question, two types of data were needed: (a) data on each subject's performance on the Arithmetic Drill Game, and (b) data on each subject's ability to demonstrate withitness and overlap skills while managing classroom-based group-learning situations.

Each subject played the game at a time of their convenience within a designated one-week period. Though preliminary instructions were given concerning the computer, keyboard and CRT screen, actual research questions or purposes were not discussed. After this initial orientation, each subject completed reading the instructions (7-8 minutes), playing the game (10 minutes), and answering the final four questions (1-2 minutes).

During actual playing of the game, the following data points were collected for each subject: (a) number of selections of a volunteer or a non-volunteer made within the 10-minute playing period, (b) number of correct and incorrect alternations between volunteers and non-volunteers, (c) number of assessments of correctness of student responses made within the 10-minute period, (d) number of correct and incorrect assessments of student's responses, (e) number of times Ian was off task within the 10-minute playing period, and (f) total time (measured in microseconds) Ian was off task within the 10-minute playing period. Additionally, correctness of response to each of the final four questions was recorded.

The second type of data collected addressed the subjects' ability to demonstrate withitness and overlap skills while managing group-learning situations. Each subject had student taught for 15 weeks in each of two public school settings during the previous school year. Each student teaching experience had been completed under the supervision of one of five university staff members, all specially trained in supervisory techniques, and each having extensive experience both in teaching school and in supervising student teachers. Thus, each subject had worked under and been observed by two university supervisors.

After hearing a detailed explanation of the nature of withitness and overlap, each supervisor was asked to rate their supervisees' competency in the skills. The rating was done using a 5 point, Likert-type scale with one end (5) labeled as "exceptionally talented, shows unusual ability" and the other end (1) labeled as "shows little ability, very weak". The mid-point (3) was labeled, "average ability with respect to other student teachers in program".

The ratings from each of two supervisors were compared for each subject. Whenever the ratings did not match, the supervisors reviewed the case, discussed perceived differences, and reached a single consensus rating.

To answer the second research question (i.e., "Does playing the game evoke thought processes and emotions similar to those experienced by the subjects while managing mainstreamed group learning situations?"), interviews were conducted immediately after each subject finished playing the game. During these interview sessions, subjects were asked the following questions: (a) "How did you feel while playing the game?" (b) "How much did the game succeed in making you think like, or even feel like, you do while you are actually teaching?" (c) "What was hardest for you in the game?" (d) "What was easiest?" (e) "Were your responses to the final four questions guesses, or did you feel very confident?" (f) "In what way was the game realistic?" (g) "In what ways was the game contrived?" (h) "What recommendations do you have to make the game better?" Responses were noted for later analysis and interpretation.

Data processing.

Before testing the correlational hypothesis relating to the first question, the game performance data, as initially gathered, had to be transformed by applying the following procedures:

1. The number of selections of pupils to respond was added to the number of assessments of students' responses. This yielded the total maintenance of routine moves made during the game (M).

2. The number of correct alternations between volunteers and non-volunteers was added to the number of correct assessments of students' responses. This yielded the total correct maintenance of routine moves made during the game (CM).

3. CM was divided by M. This yielded the number

of correct maintenance of routine moves as a percent of the total maintenance of routine moves (% CM).

4. The total time Ian was off task within the 10-minute playing period was divided by the number of times Ian was off-task. This yielded the mean time for each of Ian's off-task periods (X_I).

5. To align the ordinal dimensions of the elapsed time scores (X_I) with the maintenance of routine scores (% CM), the highest X_I score was first identified. (In the case of the present study it was 7.124 seconds.) The next whole number above that (in this case 8) was used to reverse the ordinal dimensions of the X_I scores. This reversal was accomplished by subtracting each subject X_I score from 8. This yielded elapsed time scores for each subject in which the higher score is the better score X_I .

6. Because the 10-minute time allocated for play may expire after a player selects a student but before the player has an opportunity to assess that student's response, the value for the number of selections of volunteers or nonvolunteers (#1 above) and the value for the number of assessments of correctness (#3 above) may differ by one. In such case neither would truly reflect the number of problem cycles completed by the player. To derive this number, the value of #1 above is added to the value of #3 above and their sum is divided by 2. This yields the actual number of problem cycles completed (P).

While playing the Arithmetic Drill Game, it is possible for a subject to improve his/her maintenance of routine score (%CM) by ignoring Ian's off-task behavior score (X_I) may be obtained by devoting less attention to maintenance of routine. Further, both scores may be improved if the subject is cautious, devoting much time to thought and reflection and thereby completing a lesser number of problem cycles (P) during the 10-minute playing period.

The final data processing task was to derive a single score which reflected a combination of the 3 measurements" %CM, X_I , and P. This score (game score) should correct any inflation of a single component score obtained at the expense of the other component scores.

The game score was derived by first multiplying the %CM score by the P score. Their product was then multiplied by the X_I score. This final product was then divided by 10. The resulting game score reflects the player's total effort in the game, a result of speed and accuracy in attending to different tasks

(one of which is a vigilance task) simultaneously. These results are displayed in Table 1.

Data analysis and results. Two types of data analysis were undertaken. First, to test the correlational hypotheses generated from the first research question, a Pearson product-moment correlation coefficient (Ericksen, 1970) was computed. Ratings supplied by the subjects' supervisors were entered as the Y variables while the subjects' game scores were entered as the X variables. The results of this computation were $r = .7599$ which suggests that, in this group of subjects, approximately 56% of the total variance in ratings of withitness/overlap ability is explained by a linear relationship between those ratings and subject's performance scores on the Arithmetic Drill Game.

To develop answers to the second research question, the results of the postgame interview were examined. (Note: Interview data were not available for three subjects.) Typical responses to each question are listed below:

1. "How did you feel while playing the game?" Typical answers included: "Absorbed", "excited", "anxious", "It was over so quickly." Additionally, a number of subjects responded to this initial question by wanting to know if they had a good score and/or offering excuses, explaining why they did not do better. Many of these excuses related to a professed fear or dislike of computers. (Note: All but two of the subjects had had no previous experience with microcomputers. The experience of the other two had been limited to playing a few common computer games.)

2. "How much did the game succeed in making you think like or even feel like you do when you are actually teaching?" All respondents were unanimous in their agreement that the thought processes required to play the game are very similar to those required when teaching in classroom-based group-learning situations. Though all agreed that they were unlikely to encounter, in actual teaching, the situation and setting presented by the game (i.e., drilling 6 pupils in single-digit multiplication while monitoring 1 silent reader), the responding subjects felt the basic thought processes were identical to those used in teaching. Further, many subjects volunteered examples from their own experiences that they felt closely paralleled the requirements of the game.

Concerning the emotions they experienced during play, most subjects were surprised that they became as emotionally involved as they did. They found themselves feeling concern, confusion, and even slight panic when mistakes were made. They remarked about remembering similar emotional reactions during stressful incidents in teaching. Many volunteered that playing the game would be a good way to demonstrate to beginning teachers what it "feels like" to be in front of a group, responsible for conducting it through a learning activity in an orderly and purposeful fashion.

3. "What was hardest for you in the game?" The majority of the subjects found that answering the situational memory questions at the end of the game was the hardest. For most, their answers were guesses. Many subjects were surprised at their occasional inability to remember the multiplication questions they had just asked, a few even resorting to systems such as asking 1×1 , 1×2 , 1×3 , etc., in order to remember. For a few, remembering to alternate volunteers and non-volunteers was difficult. One subject even maintained that the machine was inaccurate in assessing his success at alternating.

4. "What was easiest?" No subjects expressed any difficulty with understanding the directions for the game. The pace of the game was mentioned by some subjects as contributing to ease of play. They found the time spent waiting for prompts to appear was useful in recalling needed information. Some even expressed impatience with the requirement of waiting for prompts, feeling that the wait made it too easy. They would have liked to work at a faster pace than allowed by the program.

5. "Were your responses to the final four questions guesses or did you feel very confident?" As mentioned above, the vast majority of subjects admitted to simply guessing correct answers. Only two subjects expressed any confidence in knowing their answers were correct. Further, despite the clear directions to determine which pupils volunteered most and least, and which answered most correct and least correct, and despite reminders of this task that appear during the game, many subjects admitted to completely ignoring this task in favor of the the others. They decided initially that it would be too hard to do everything and so consciously abandoned attention to the situational memory task. An examination of

the situational memory scores in Table 1 supports this observation, revealing that no subjects answered all questions correctly, that less than a third answered three correctly, and that success and failure appears to be randomly distributed throughout the subject group.

6. "In what ways was the game realistic?" Again, most subjects felt that both the thought processes required and the emotions evoked by the game realistically paralleled their teaching experiences.

7. "In what ways was the game contrived?" As would be expected, almost all subjects felt interaction with the computer--typing questions, hitting keys to call on students--lacked realism. A few subjects remarked about a lack of "history" with the class. They did not "know" the pupils. Some objected to the perceived sameness of the pupils. Though the pupils had different colored shirts and different names, they still appeared too homogeneous, lacking distinguishing characteristics that would be useful in remembering their individual performances. Again the pace of the game, dictated by the display of prompts in timed sequence, disturbed some subjects. They would have liked to proceed more at their own pace. Finally, the imperative to play rapidly in order to make more points bothered some. They felt that good teaching was not necessarily fast teaching.

8. "What recommendations do you have for making the game better?" The following suggestions emerged from the interviews: (a) Allow the player more freedom to determine the pace of play. Use prompts requiring less time to display; (b) Give the pupils more distinguishing characteristics; (c) Remind the Player more often that the four questions will be asked after the game is over; and (d) Make the CRT screen easier to read by turning off overhead lights.

Discussion. The results of this first testing of the Arithmetic Drill Game were encouraging. Subject reaction was positive. The ability of the game to evoke thought processes and even emotions characteristic of actual managing classroom-based group-learning situations supports the contention that the game succeeds in simulating such situations.

The obtained value of the correlation between game scores and supervisory ratings is also quite encouraging. It must be observed that limitations of this correlational study may result from both the small sample size and the relatively high inferential

nature of the supervisors' ratings.

While the results of this evaluation efforts support the assumptions that the Arithmetic Drill Game both simulates aspects of teaching in classroom-based group-learning situations, and provides scores related to players' withitness/overlap abilities, it is also clear that additional work is required. Subjects were consistent in some recommendations for improvement. Listed below are possible modifications, suggested by the evaluation data, which might improve the ability of the Arithmetic Drill Game to simulate the target aspects of group instruction and might improve the ability of the game scores to predict success in tasks requiring withitness/overlap facility.

1. Modify the appearance of the six "pupils" displayed on the screen so that their heterogeneity is accented.

2. Modify the prompts and the timing of their display to allow subjects to proceed at their own pace.

3. Remove the situational memory task (the final four questions) from the game, replacing it with an additional task which would compete for the subject's attention with the other tasks present.

4. Conduct a validity study with the game thus modified, using as Y values data obtained from more rigorous, low-inference, direct observation of subjects working in classroom-based group-learning situations. Such data could provide a more reliable rating of subjects' withitness/overlap ability and thus, would allow more confidence in correlations obtained.

Finally, and perhaps most interestingly, the results of this evaluation effort indicate that recommendations to teachers concerning how they should behave while teaching in classroom-based group-learning situations may be necessary but not sufficient conditions for success. The subjects in this evaluation all recently completed the same teaching credential program and so, presumably, received similar recommendations for successful teaching. Yet, the ratings provided by their supervisors indicate that all did not experience similar success in implementing recommendations related to management of student learning. The correlational test suggested that over 50% of their variance in ability to implement the target recommendations can be attributed to the subjects' withitness/overlap ability as measured by the Arithmetic Drill Game.

The mediating effects of this ability on the

outcome of teacher education programs have not previously been considered by teacher educators. The possibility of interaction between instruction to teachers and their abilities on such tasks as withitness and overlap (an aptitude-treatment interaction) is both intriguing and supported by the present findings. This possibility raises the further question of whether withitness/overlap are truly aptitudes and therefore stable over time or cognitive skills and therefore amenable to training. Though this question is raised by the present study, answers are not provided. Clearly, the present project opens more avenues of research and raises more questions than it answers.

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Clinical Knowledge and the Unique Role of
Simulation as an Instructional Strategy for
Teacher Education: A Participant's Perspectives
Marcia J. Keith

"When I use a word," Humpty Dumpty said in rather a scornful tone, "it means just what I choose it to mean - neither more nor less." (Lewis Carroll, Alice Through the Looking Glass)

"Clinical knowledge" is a phrase found regularly in teacher education literature, usually in conjunction with "clinical experience". It is likely that what we teacher educators choose clinical knowledge to mean depends upon whom one asks - each of us has a Humpty Dumpty perspective.

This paper will describe the variety of meanings attached to "clinical knowledge" by the participants in the Invitational Symposium on Simulation in Teacher Education. In addition, a tentative matrix which relates types of knowledge with possible instructional strategies will be presented. This matrix indicates a special role for simulation as an instructional alternative available to teacher educators; and provides direction for the future development of simulations by identifying general categories where such instructional alternatives are appropriate.

It should not be concluded that this paper presents a finished product which describes the consensus of the participants, for discussion did not reach that point. Rather, the aim is to provide the reader with the opportunity to examine an unreflected set of participant insights which emerged during the day. It is hoped that this examination will encourage further refinement of these ideas.

What do we choose clinical knowledge to mean?

Three working groups informally presented their interpretations of the meaning of clinical knowledge in their reports to the Symposium. Listed below, these interpretations provided the data for the discussion which ultimately resulted in the formation of a tentative matrix for understanding which areas of teacher education may be best suited for simulated activities, and what clinical knowledge areas might be included within the definition provided by the matrix.

Initial Definitions of Clinical Knowledge:

1. Specialized teacher knowledge which leads to action and pertains directly to student learning. This definition is meant to acknowledge, the importance of craft knowledge or what teachers learn in the practice of teaching.
2. That knowledge which informs good professional practice for which there is both a research and experiential base (reflecting the best research available for effective teaching), and for which the practitioner is held accountable.
3. That knowledge which is reflected in behaviors which relate to practical aspects of field settings. Clinical knowledge enables teachers to carry knowledge to those settings and enact it there.

Several commonalities across these three interpretations are obvious. One is that there is an action orientation to clinical knowledge - teachers do something which is (ideally) informed by effective practice. A second area of agreement is that clinical knowledge is learned through practical experience, by forming understanding of relationships between action and the situation in which the action occurs. The third commonality is the location for the application of clinical knowledge -- a classroom situation or field setting is required where there is occasion to interpret classroom events (or, in this context, a locus that simulates these events).

The major area of disagreement across these definitions of clinical knowledge concerns the applicability of the notion of student learning. Does clinical knowledge relate to settings where student learning is identified as the ultimate objective? Can one speak of clinical knowledge without reference to student learning by arguing, for example, that clinical knowledge is that knowledge which enables teachers to effectively manage the activity flow while enacting the curriculum. Discussion among the participants in the Symposium did not resolve this issue, yet it seems to have a major implication for teacher educators: Should the purposes of experiences designed to develop clinical knowledge in preservice students be determined by what we know about learning or by what we know about teaching or by both? It will be seen that the framework to be presented below only considers the tasks of teaching, and assumes

that the distal objective of student learning will more or less occur.

So what did the participants in the Symposium choose to have clinical knowledge mean? A suggested definition was presented which attempted to consolidate many of the points made during the discussion of the original three described above. Immediate modifications were offered, and one alternative definition provided! However, it does seem appropriate to indicate that the following generally reflects the views of many participants:

Clinical knowledge is that knowledge which informs (or undergirds) the effective differential use of teacher actions in classroom settings. It enables teachers to interpret events and to determine when to do which action from the range of available choices. Some characteristics of clinical knowledge are:

- 1) it is conditional, i.e. tied to cases and instances;
- 2) it consists largely of action-situation relationships;
- 3) it is dynamic.

A matrix for organizing instructional strategies

Given this working definition of clinical knowledge, participants developed the following matrix. It was not meant to be inclusive of all the possible instructional strategies available to teacher educators, nor was it meant to represent the total list of outcomes or to suggest that each of the listed outcomes might only be taught using the method checked. Rather, the matrix should be viewed as a way of identifying the unique role of simulation in teacher education. That is, if clinical knowledge is important to the success of a beginning teacher, and if clinical knowledge may be thought of as defined above (e.g. action oriented, conditional, interpretive in nature), then it is imperative that simulated experiences be provided to develop such knowledge. Without it, one must hope that student teaching will provide the requisite experiences ... with real children in an extremely complex environment, with little time for feedback or for providing knowledge of results to the student teacher. That, indeed, has been the posture of those SCDEs which do not use simulation.

TEACHER EDUCATION INSTRUCTIONAL STRATEGIES

OUTCOMES	Lecture	Discuss	Exemplars	Practice	Simulations
Knowledge about the history of education	X e.g.				
Knowledge about the goals of ed.		X e.g.			
Concepts useful for understanding or knowing about			X e.g.		
Competencies useful in knowing how				X e.g.	
Capabilities useful in knowing when or interpreting system					X e.g.

(figure 1)

Again, it should be remembered that the "X" under Lecture, for example, as a strategy for providing knowledge about the history of education does not mean that only a lecture strategy may be or ought to be used by teacher educators. However, the matrix does raise some interesting ideas for speculation. For example, is it useful to think of the outcomes of teacher education programs in such a hierarchical fashion with knowledge about things coming first and then, ultimately, opportunities provided to interpret, to make choices, in other words, to develop clinical knowledge of teaching?

Secondly, does the matrix indicate that there may be a best way to provide instruction to preservice students depending upon the outcome desired? Certainly, it at least indicates that a variety of options are available, and in the case of clinical knowledge, simulation seems to be particularly appropriate - the instructional strategy of choice.

Finally, would it be useful for the faculty of an SCDE to complete such a matrix, using the specific outcomes from their own program? Would such an activity provide a unifying view and offer direction for both staff development and program/equipment development?

This matrix was presented at the Symposium as a way of looking at the relationship between clinical knowledge and simulation. The "ideas for speculation" were not discussed, nor was the matrix meant to be more than a notion created on-the-spot to provide some assistance with the discussion. It does seem, however, that this way of looking at instructional strategies is worth additional consideration.

Aspects of clinical knowledge

Having both defined clinical knowledge and tentatively identified simulation as the instructional method of choice for developing such knowledge, there remained the task of describing the categories of clinical knowledge which would be of most use to beginning teachers and which, by inference, ought to be developed into simulated activities. The way in which this task was accomplished was to pull out the section of the Strategies matrix (figure 1) labeled "Simulations" on the vertical axis and "Capabilities useful in knowing when or interpreting the system" on the horizontal axis. The following resulted:

SIMULATIONS			
Planning <----> Implementing <----> Evaluating			
Capabilities Useful in Knowing when	1	3	5
or Interpreting System	2	4	6
			Managing Social Systems Enacting Curriculum

(figure 2)

This second matrix identifies six areas of clinical knowledge which were generally accepted by the Symposium participants as important, if not essential, to the success of a first year teacher:

1. Planning related to the managing of the social systems of the classroom (opening of school, establishing rules, setting routines, etc.)

2. Planning related to enacting the curriculum (long and short term planning, translating content, meeting individual needs, etc.)
3. Implementing plans to manage the social system (feedback, expectations, desists, etc.)
4. Implementing plans to enact the curriculum (active teaching, pacing, questioning, etc.)
5. Evaluating the social systems of the classroom (observation, monitoring, "overlapping, "withitness," etc.)
6. Evaluating the enactment of the curriculum (diagnostic monitoring, probes, error analysis, etc.)

It is important to keep in mind that participants were not talking about a conceptual understanding of these six areas, nor were they discussing the practice of behavioral skills. Rather, participants were talking about providing the preservice student with occasions to interpret classroom events, and to make decisions as to which actions are appropriate from the range of possible choices available to them. In other words, members of the symposium were describing simulations which would provide for the development of clinical knowledge.

Three other dimensions of this framework for simulations were identified by the participants: reflection <-> action; skill <-> strategy; setting <-> situation. Discussion of these dimensions was limited, but it can be seen that such dimensions could provide for a more specific description of simulations. The following example is illustrative:

Capabilities useful in interpreting system or knowing when

- I. Managing social systems - action
 - A. Planning related to the managing of social systems - strategy
 1. Opening of school - situation
 - a. Organization of classroom space (e.g.)
 - b. ...
 - c. ...

In this sense, figure 2 (above) could provide a taxonomy which would serve to identify an agenda for the future development of simulations - those "empty cells" where no simulations currently exist

could provide such direction. (At the current time, "empty cells" are the rule, rather than the exception.) A second purpose for such a classification system would be to avoid duplication of effort. Given limited resources it seems sensible to establish a network or perhaps a clearinghouse, the purpose of which would be to receive descriptive information from simulation developers and enter it into the classification system format. This information would then be available to interested parties as requested.

Neither more nor less

What has been presented in this paper should be considered the author's perspectives as a participant in discussions which occurred during the Invitational Symposium on Simulation in Teacher Education. The matrix on Instructional Strategies and the section from it which yielded the six aspects of clinical knowledge considered important for beginning teachers are presented as ideas that need further reflection and refinement. However, if additional discussion is stimulated by the above, and if this discussion results in a more general acceptance of the importance of simulation, and in a recognition of the need for some way of indexing simulations as they are developed, then participants in the Symposium could hope for neither more ... nor less.

Symposium Summary
E. Dale Doak

This "Symposium on Simulation in Teacher Education" represents (to this writer's awareness) the first of its kind. The idea has been around for more than twenty years in various forms. Kersh began the movement with his "teaching simulator" of the early sixties. Allen followed with micro teaching, perhaps the most used and certainly the most thoroughly researched of all the simulations. The "Inner City Simulation Laboratory" and the "Teaching Problems Laboratory," developed by Cruickshank in the late 1960's - early 1970's were clearly different forms of simulation in teacher education, emphasizing problem solving and critical thinking about teaching. The protocol development of the mid 1970's, under the leadership of B.O. Smith, continued the emphasis upon thinking about and analysis of teaching. Cruickshank's "Reflective Teaching," developed in late '70's and early '80's made strides toward "content free" peer teaching and subsequent reflection upon teaching as a process. The latest thrust, computer simulations, promises much. Early developers here include Copeland, Dersheimer, Brown, and Gliessman.

One of the primary goals of the symposium was to examine or define the state of the art in simulation in teacher education. Participants generally agreed that the development is embryonic but that there is definitely a renewed interest in simulation. Perhaps this renewal for the process and enhancement of on-campus laboratory experiences grows out of the general interest for renewal of teacher education. Perhaps technology has stimulated creative minds to find ways to project teacher education students into "life-like" situations as a strategy. It may well be that the profession has matured and now realizes/agrees that "talk about" teaching would best be preceded by knowledge about and experience in teaching. In addition, the recent research on teaching furnishes a knowledge base for development of simulations here-to-fore relatively undefined. All of these, and more, set the stage for the development of a powerful strategy-simulation. There seems to exist an enthusiasm about, and general acceptance of, the approach that simply awaits further development.

Several seminal ideas evolved from the symposium which are related to teacher education and laboratory

experiences in general and to simulation in teacher education in particular. These include:

- the general model for learning poised by Edgar Dale's "Cone of Experience" and Bruner's "Modes of Representation" are reversed in teacher education. We move from symbolic, abstract theory about teaching (talk) to more concrete, and active modes (student teaching). Why do we do that? One could project a model initial teacher preparation program where all activities were practical, real or simulated experiences. Instead, most initial programs emphasize symbolic, enactive learning strategies.
- on-campus laboratory experiences are currently underdeveloped, underutilized. Why? Is the development of these experiences too costly? Too incomplete? Is the implementation (i.e., micro teaching) too time consuming for faculty? Is it possible that talk about teaching is not only less time consuming but less threatening to the college professor? Or perhaps we have simply attempted to substitute "real" experiences in the schools for simulated ones and in so doing overlooked the advantages of safe, controlled, highly focused labs.
- every simulation has outcomes well beyond specific planned outcomes. A micro lesson emphasizing "feedback" may well furnish the "stuff" for analysis of a problem or teaching episode never intended but vitally important to teachers. Perhaps students analyzing the micro lesson on tape learn to look for and recognize a variety of teacher behaviors. Some may build much needed confidence in their ability to teach. The end result may well be to produce students of teaching as well as to teach ideas related to "feedback."
- perhaps the profession is currently involved in a search for the "structure of knowledge" for teacher education. The research base is certainly stronger and more definitive than ever before. At best, however, it remains imperfect. Thus, craft knowledge remains

an important part of any program for the preparation of teachers. Obviously, the profession desperately needs to develop a unifying set of principles, the Gestalt of teacher education, the underlying superstructure if you please. Until such definition/direction is determined any developmental trust will be highly fragmented, highly individualistic and highly ineffectual.

- having just identified the absence of clear direction in teacher education generally it should not be surprising that there exists no national, unified agenda for the development of simulations in teacher education. John Kennedy focused this nation's energies upon a primary goal in the 1960's - going to the moon. And once focused we proceeded to do just that. What teacher education desperately needs is a focus. How else can we logically expect to develop a critical mass for the coordinated development of instructional materials for teacher education? Why not, as a beginning, agree upon six basic principles underlying effective teaching? Or eight? Or four? These principles should not be thought of as the teacher education program but as six basic principles that all teachers should be knowledgeable about, able to do, etc. Such a focus has broad implications for development and dissemination of instructional materials for teacher education, including simulation.

The symposium served one final purpose - that of providing a beginning for a communication/support group. People with similar interests who have approached the development of programs from different vantage points, different perspectives, certainly have the unique opportunity to build upon the relationship. And that promise has potential for future developments.